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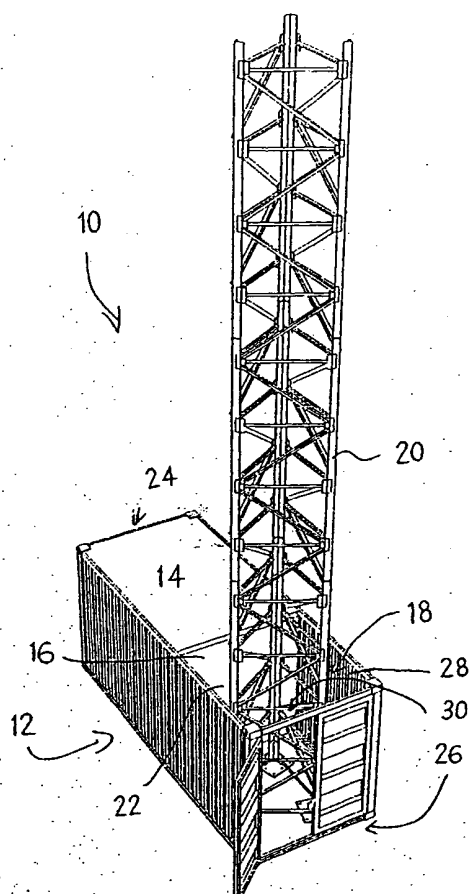
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(54) Title: INSTALLATIONS FOR WIRELESS COMMUNICATION



(57) Abstract: A telecommunications installation that includes a tower or mast and an associated secure enclosure for housing telecommunications and ancillary equipment. The enclosure may be a standard shipping container modified by means of a secure separator wall and by making at least a portion of the roof removed for the tower or mast to extend through the opening thus created. An alternative is a purpose-made secure enclosure, which is square in plan view, having four legs at outward positions of corners of the enclosure, the legs providing structural support for the tower or a base frame of a mast. The legs are through bolted to corner pieces and wall panels which constitute the container. In either case a secure door and lock is provided comprising hinges recessed into the door stile and a bolt recessed into the door so as to be inaccessible to vandalising or attempted break-in.

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INSTALLATIONS FOR WIRELESS COMMUNICATION

Field of the Invention

- 5 The invention lies in the field of installations for wireless communication applications, such as mobile telephony (also known as cellular telephony).

Background

- 10 In mobile telephony, and generally in wireless communication applications, installations must include antennae mounted on masts or towers of various substantial heights, together with electrical and electronic telecommunications equipment, ancillary equipment and a stand-by generator. These are required at numerous sites in order to provide coverage over a large area. These
15 installations are generally installed on a purchased or rented site. A typical installation site covers between 50m² and 100m², depending on the size of the mast.

- In addition to the relatively large surface area requirement, the presently
20 available installations are relatively difficult to transport into remote locations as the telecommunications equipment, stand-by generator and the mast are transported separately.

- Usually the telecommunications equipment is placed in a secured, air-
25 conditioned room, which may be in the form of a caravan or a similar prefabricated construction. As the air conditioning units protrude from out of the room or prefabricated structure they are prone to theft and vandalism and thus an area surrounding the telecommunications room must be fenced or walled off and secured against unauthorised entry.

- 30 Even inside the secured room, the telecommunications and ancillary equipment is subject to break-in and theft, i.e. burglary and the expensive equipment is

vandalized and/or stolen. A prime target is the stand-by batteries, for example. Apart from the direct financial loss represented by the equipment and damage to the room, the telecommunications/radio communication service is interrupted until repair/replacement can be carried out. This task must be carried out by
5 skilled technicians and some localities are remote, thus representing a substantial cost.

The applicant believes that by using an installation for wireless communication in accordance with the invention the above shortcoming of present systems may be
10 at least partially alleviated.

The Invention

Thus, according to the invention, there is provided a telecommunication
15 installation that includes a secure enclosure and an associated tower or mast, the enclosure adapted for housing telecommunications and ancillary equipment in a fashion secure against forcible entry and having structure associated with the enclosure configured to, in use, permit the mast or tower or components thereof to extend in a generally upward direction.

20

In accordance with some embodiments, (e.g. especially for use in association with a tower which serves as an imitation tree), the installation includes a housing which has a zone which provides the secure enclosure and an adjacent zone in which at least a roof or roof panel is removed or opened to permit the mast or
25 tower to extend from out of the zone in a generally upward direction.

The housing may be a standard six sided shipping container modified by division into two zones by means of a secure separator wall located intermediate two opposing sides and further modified by making at least a portion of the roof
30 removed for the tower or mast to extend through the opening thus created.

Where the tower or mast stands on legs, the legs of said mast or tower may be located substantially inside the associated zone, with the tower or mast extending upwardly above the compartment.

5 Typically the shipping container will not need to be strengthened and the modifications will not compromise the shipping ability of the container so that a container having the two compartments may be shipped like any ordinary shipping container.

10 The secure enclosure may be internally insulated and will generally be fitted with air conditioning units in order to keep the telecommunications and ancillary equipment at suitable operating temperatures. The heat exchangers which release heat to the exterior and/or compressor portions of the air conditioning units may be located within protective surrounds, thereby to inhibit unauthorised
15 access, tampering with the air conditioning units, vandalism and/or theft.

The vandal and tamper resistance may be imparted by conventional means such as a metal grill being placed over said heat exchanger and/or compressor and/or any access openings.

20

Where the installation is provided with the housing, e.g. a shipping container modified as described, the adjacent zone, in which the tower or mast is located, may conveniently provide the desirable protective surround, being the walls of the housing. Even though the roof is left open, for the tower/mast, the height of
25 the walls provides a degree of protection.

The roof may be left open only sufficiently for the tower legs/mast to protrude through the roof, effectively closing the roof against entry, this will protect the air conditioning components more effectively.

30

The adjacent zone may be modified to house the tower or mast for the antennae, the modification required being largely dependant on the type of tower or mast to be housed therein, for example, a 3 sided lattice tower, a 4-sided lattice tower, a monopole tower, a tree tower, a billboard tower, or any other tower or mast
5 suitable for wireless communication.

Typically the adjacent zone and the structurally strong legs will in each case be configured to permit anchoring of the tower or mast and for the tower or mast to extend from out of the second compartment when the tower or mast is erected.

10

These may be configured to permit the tower or mast, which has been transported with the secure enclosure and delivered to site, to be conveniently erected. All the components for erecting the tower or mast may be transported within the adjacent zone or in the protective surrounds and erection thereof may
15 immediately proceed.

20

The installation for telecommunications antennae may include a third compartment for housing a generator and/or batteries. However, the generator may be located in the adjacent zone under the tower or mast.

The container may be a standard 20 foot i.e. 6 m shipping container, in which case the footprint of the container is about 15m^2 , which is less than a third of a conventional installation of this type.

25 In accordance with another preferred embodiment of the invention, the container may be purpose made and square in plan view, having four legs at outward positions of corners of the container, the legs selected to provide structural support for the tower or for a base frame of a mast, the legs through bolted to corner pieces and wall panels which constitute the container.

30

In these embodiments, the four legs are structurally strong enough to support a tower or a mast, or constitute the legs themselves of the mast or tower, configured to allow legs of a tower or legs of a base of a mast, to extend in a generally upward direction, the legs located at four corners of the secure enclosure.

This container may be internally insulated and be fitted with air conditioning units in order to keep the telecommunications equipment at one or more operating temperature. In this case the radiators and/or compressor portions of the air conditioning units may be located outside the container but enclosed in vandal/theft protective ventilated enclosures.

The container of the installation may be provided with aesthetic cladding such as plant or rock type camouflage or advertising billboards.

The container may be provided with additional security by providing cladding of a height greater than the height of the container thereby making unauthorised access to the container more difficult. Additionally, the container may be provided with security gates or doors, razor wire, electric fencing, spikes, or other unauthorised access deterrent means.

In use, the enclosure is placed on one or more support plinths with ground anchors being used to anchor and stabilise the mast or tower.

The ground anchors may include a plurality of piles, each pile including a concrete filled passage which extends into the ground and at least one anchor located in the passage and embedded in the concrete.

The ground anchors may include a base including opposed spaced lower and upper steel plates with a plurality of ribs or other reinforcing between opposing surfaces of the plates. Fixing means may extend from an upper surface of the

upper steel plate and the fixing means may be secured to the tower or mast base or legs.

5 The anchor may be a rod or a cable having a ground engaging member secured to it which provides an initial anchor to the ground and is thereafter embedded in concrete.

10 Further attention to the security of the container, whether it is a standard shipping container, or a purpose made container, in accordance with the invention, is desirable in regard to the access door built into the container. It has been found with existing enclosures that unauthorised access is gained by sawing or cutting off exposed parts of the locking mechanism, hasp and staple, padlock, door hinges, bolts, attachment plates etc.

15 The present invention provides a lock mechanism comprising a bolt, which is pivotally mounted on a pivot pin which is located behind a front surface of a door, the bolt recessed into a recess in the door, so that its outer surface is flush with the front surface of the door when in a secured position and means to lock the bolt when it is in this position. An end of the bolt will project into a stile, lintel
20 and/or sill of the door frame, when door is closed and the bolt is in the position in which its surface is flush with the door outer surface. When the bolt is unlocked and pivoted out from the outer surface of the door, its end disengages from the frame.

25 When it is said that the surface of the bolt is flush with the outer surface of the door, it is intended to cover also the case where at least parts of the bolt near the pivot pin and near the locking means are flush, other projections, which are not essential to the functions of these parts, can be allowed.

30 The locking means can be various types of recessed or otherwise protected locking mechanisms.

A preferred locking means is a hasp formed in a recessed portion of the bolt and fitting when in the secured position over a staple which projects from the recessed part of the door into which the bolt is recessed, through an aperture in the hasp, when in the secured position. This allows the use of a padlock, which will be sheltered in the recess in the bolt when locked onto the staple.

Other hidden or concealed locking mechanisms built into the door can be used, for example, actuated by a key inserted into a keyhole in the front surface of the door.

10

Two or more such flush mounted bolts can be provided on a door and it is possible to link the locking means of more than one bolt to effect a single locking action which will lock all.

15

The invention further provides a door hinge structure which comprises a flat plate which is fixed to a door and hinged on a hinge pin which is located behind the front surface of a stile, lintel or sill of a door frame, the frame having a slit into which the plate fits, presenting its narrow edge to the slit opening at the front surface of the frame, when the door is closed. This shelters the plate and hinge from attempts to cut or break it, to gain unauthorised access. Usually two such plates will be fixed to an upright edge of the door, fitting into narrow slits in one stile of the door frame and hinged on hinge pins inside the door frame, to provide a horizontal swing of the door on a vertical axis.

20

The word door used herein must be interpreted in a broad sense as covering any closure for an opening, including a hatch, lid, shutter or other closure.

25

The Drawings

The invention will now be described by way of example only, with reference to the accompanying diagrammatic drawings.

30

In the drawings,

Figure 1 shows, in three dimensional view, a telecommunications lattice tower and container broadly in accordance with the invention;

5

Figure 2 shows, in three dimensional view, a monopole telecommunications tower and container broadly in accordance with the invention;

Figure 3 shows, in three dimensional view, a camouflaged tree type tower and
10 container combination;

Figure 4 shows, in side view, a telecommunications tower and container of Figure 1, wherein the container is clad with security cladding; and

15 Figure 5 shows, in three dimensional view, a telecommunications lattice tower and container showing the ground anchor detail.

Figure 6 shows an installation according to another embodiment of the invention,

20 Figure 7 shows in isometric view the secure enclosure of the embodiment of figure 6, with associated structure for the mast,

Figure 8 shows a plan view on the secure enclosure,

25 Figure 9 shows an enlarged plan view of a corner construction of the secure enclosure,

Figure 10 is a view onto the front surface of a door with a lock bolt and hinges according to a preferred embodiment of the invention,

30

figure 11 is view of the lock bolt in the secured position,

figure 12 is a cross sectional view of the lock, on section normal to the door front surface,

5 figure 13 is view of the lock bolt in the open position,

figure 14 is a view onto the edge of the door showing the end of the bolt which engages the stile,

10 figure 15 is a perspective view of the bolt,

figure 6 is a view showing a concealed or protected hinge according to a preferred embodiment of the invention,

15 and

figure 17 is a cross sectional view of the hinge, on a horizontal section through the door and stile, at a hinge.

20 The Preferred Embodiments

In Figures 1 to 5, reference numeral 10 generally indicates an installation including a telecommunications tower 20 and a container 12 divided into a secure enclosure zone 14 and an adjacent zone 16 for the tower.

25

The enclosure 14 is made secure against unauthorised or forcible access and is used for housing telecommunications and associated equipment. This enclosure is insulated and air-conditioned to provide an environment suitable for operation of the telecommunications equipment in the enclosure 14.

30

The adjacent zone 16 is configured to, in use, have an upper side 18 removed or opened to permit a lattice tower 20 to extend from out of the second zone 16 in a generally upward direction.

5 In Figure 5, the second compartment 16 is configured to, in use, have only corner portions 17 of an upper wall or roof 28 removed or opened to permit legs of a lattice tower 20 to extend from out of the second compartment 16 in a generally upward direction.

10 The container 12 is a standard six sided 20 foot shipping container modified by division into the two zones 14 and 16 by means of a separator wall 22 located intermediate the ends 24, 26 of the container. Thus the tower 20 extends upwardly above the container 12 zone 16 while leaving the roof 28 substantially intact.

15

The container 12 does not need to be strengthened and the modifications will not compromise the shipping ability of the container so that the container 12 having the two zones 14 and 16 may be shipped like any ordinary shipping container.

20 The first zone 14 is internally insulated and fitted with air conditioning units in order to keep the telecommunications equipment at operating temperature. The configuration of the installation 10 permits the external heat exchangers and/or compressor portions of the air conditioning units to be located within the second zone thereby to inhibit unauthorised access and tampering with the air
25 conditioning units while still permitting the flow of air over the heat exchangers for heat exchange with the environment. However, in some embodiments (not shown) a conventional configuration in which the air conditioning units are directed outwardly may be used.

The second zone 16 is modified to, in transit, store the components of the tower 20 as well as any other parts required for on site assembly of the installation and, in use, house the tower 20.

- 5 The second zone 16 is configured to permit anchoring of the tower 20 and for the tower 20 to extend from out of the second zone when the tower is erected.

As shown in Figure 5, in use, the container 12 is placed on two support plinths 40, 42 located at the telecommunications enclosure 14 end of the container 12
10 with ground anchors 44, 46, 48, 50 being used under compartment 16 directly below the tower 20 to anchor and stabilise the tower 20.

The ground anchors 44, 46, 48, 50 include a plurality of piles, each pile including a concrete filled passage (not shown) which extends into the ground and at least
15 one anchor located in the passage and embedded in the concrete. Fixing means 52 extend from an upper surface of an upper steel plate 54 of each ground anchor 44, 46, 48, 50 and the fixing means 52 are secured to the tower 20 legs 56, 58, 60, 62.

- 20 The second zone 16 and the tower 20 are configured to permit the tower 20 to be transported predominantly inside the second zone so that when the container is delivered to site all the components for erecting the tower 20 may be found within the second zone 16 and erection thereof may immediately proceed. This permits the installation to be assembled and tested at the factory prior to partial
25 disassembly of the tower 20 for shipping. At the site where the installation is required the container 12 is positioned whereafter the tower 20 is reassembled and after connection to electricity the installation is operational without the need for extensive building and/or commissioning activities at the site.

The container 12 is standard 20 foot i.e. 6 m shipping container, having a footprint of about 15m², which is less than a third of a conventional installation of this type.

- 5 In Figure 3, the container 12 of the container 10 is provided with aesthetic cladding in the form of a hedge 32 while the tower 20 is camouflaged as a tree.

In Figure 4, the container 12 is provided with additional security by providing cladding 34 of a height equal to the height of the container 12 thereby making
10 unauthorised access to the container 12 more difficult. In an embodiment not shown the cladding is higher than the container and the container is additionally provided with security gates or doors, razor wire, electric fencing, spikes, or other unauthorised access deterrent means.

- 15 The applicant believes that the invention as illustrated in the Figures has the advantage that an antennae arrangement may be constructed, commissioned and signed over at a fully equipped manufacturing facility before the tower is disassembled and packed into the container for shipping to site where minimal technical input is required in order to get the antennae arrangement operational.

20

Figures 6 to 9 show another embodiment in which a secure enclosure 70 has four corner posts 75, which are made strong enough to form the legs of the tower 71. A pedestal 72 is provided at the top of each post for the tower legs to be built upward from there. The posts have a plurality of elongate structural members or
25 stringers 73 joined between them and these support panels 74 which enclose the secure enclosure. External parts of the air-conditioning are protected by a protective surround or housing 76 which is suitably perforated for air flow. The posts rest on plinths 77 which are securely founded as described above. A door 78 is provided. Heat insulation 79 is provided inside the walls and roof of the
30 enclosure. At each corner the posts have an internal corner post 80 through bolted to include in the bolting the stringers. This creates a space 81 running

from top to bottom which is left open at the top, the roof seals onto the internal posts 80.

5 As shown in figures 10 to 15, the lock 81 comprises a bolt 82, which is pivotally mounted on a pivot pin 83 (figure 15), which is located behind a front surface 84 of the door 85. The bolt is recessed into a recess 86 in the door, so that its outer surface is flush with the front surface of the door when in a secured position.

10 Means to lock the bolt when it is in this position comprises a hasp 87 formed in a recessed portion 88 of the bolt and fitting when in the secured position over a staple 89 which projects from the recessed part of the door into which the bolt is recessed, through an aperture 90 in the staple, when in the secured position. This allows the use of a padlock (not shown), which will be sheltered in the recess in the bolt when locked onto the staple.

15 An end 91 of the bolt (figures 14 and 15) will project into a stile 92 of the door frame 93, when door is closed and the bolt is in the position in which its surface is flush with the door outer surface. When the bolt is unlocked and pivoted out from the outer surface of the door, it disengages from the frame.

20 As shown in figures 16 and 17, the invention further provides two door hinge structures which each comprise a flat plate 94 which is fixed to an upright edge of the door and hinged on a hinge pin 96 (figure 6A) which is located behind the front surface 95 of the stile. The stile of the frame has a slit 97 into which the plate fits, presenting its narrow edge 98 to the slit opening at the front surface of the frame, when the door is closed. This shelters the plate and hinge from attempts to cut or break it, to gain unauthorised access. The hinges provide a horizontal swing of the door on a vertical axis.

30 It will be seen that the bolt is given a recess 99 (figs. 13 and 14 only), to serve as a handhold to pivot the bolt outwardly from its flush position, to unlock the lock.

It will be appreciated that the position of the hinge pins allows the door to swing open without fouling on the stiles.

- 5 A seal can be provided around the periphery of the door.

CLAIMS

- 5 1. A telecommunication installation that includes a secure enclosure and an associated tower or mast, the enclosure adapted for housing telecommunications and ancillary equipment in a fashion secure against unauthorised or forcible entry and having structure associated with the enclosure configured to, in use, permit the mast or tower or components thereof to extend in a generally upward direction.
- 10
2. An installation as claimed in claim 1, in which the installation includes a housing which has a zone which provides the secure enclosure and an adjacent zone in which at least a roof or roof panel is removed or opened partially to permit the mast or tower to extend from out of the zone in a generally upward direction.
- 15
3. An installation as claimed in claim 2, in which the housing is a standard six sided shipping container modified by division into two zones by means of a secure separator wall located intermediate two opposing sides and further modified by making at least a portion of the roof removed for the tower or mast to extend through the opening thus created.
- 20
4. An installation as claimed in claim 3, in which the tower or mast stands on legs and the legs of said mast or tower are located substantially inside the adjacent zone, with the tower or mast extending upwardly above the compartment.
- 25
5. An installation as claimed in either one of claims 2 or 3, in which the shipping container is not strengthened and the modifications do not
- 30

compromise the shipping ability of the container so that a container having the two zones may be shipped like any ordinary shipping container.

- 5 6. An installation as claimed in any one of claims 1 to 5, in which the secure enclosure is internally insulated and fitted with air conditioning units in order to keep the telecommunications and ancillary equipment at suitable operating temperatures.
- 10 7. An installation as claimed in claim 6, in which the heat exchangers which release heat to the exterior and/or compressor portions of the air conditioning units are located within protective surrounds, thereby to inhibit unauthorised access, tampering with the air conditioning units, vandalism and/or theft.
- 15 8. An installation as claimed in any one of claims 2 to 6, in which the roof is left open only sufficiently for the tower legs/mast to protrude through the roof, effectively closing the roof against entry.
- 20 9. A telecommunications installation, which includes a purpose made secure enclosure, which is square in plan view, having four legs at outward positions of corners of the enclosure, the legs selected to provide structural support for the tower or for a base frame of a mast, the legs through bolted to corner pieces and wall panels which constitute the container, the four legs being structurally strong enough to support a tower
25 or a mast, or constitute the legs themselves of the mast or tower, configured to allow legs of a tower or legs of a base of a mast, to extend in a generally upward direction.
- 30 10. An installation as claimed in claim 9, which is internally insulated and fitted with air conditioning units in order to keep the telecommunications equipment at one or more operating temperature, the heat exchangers

and/or compressor portions of the air conditioning units located outside the enclosure but enclosed in vandal/theft protective ventilated enclosures.

- 5 11. An installation as claimed in any one of claims 1 to 10, in which the enclosure or container of the installation is provided with aesthetic cladding such as plant or rock type camouflage or advertising billboards.
- 10 12. An installation as claimed in any one of claims 1 to 11, in which the enclosure or container is provided with additional security by providing cladding of a height greater than the height of the enclosure or container thereby making unauthorised access to the container more difficult.
- 15 13. An installation as claimed in any one of claims 1 to 12, in which the enclosure is placed on one or more support plinths with ground anchors being used to anchor and stabilise the mast or tower.
- 20 14. An installation as claimed in claim 13, in which the ground anchors include a plurality of piles, each pile including a concrete filled passage which extends into the ground and at least one anchor located in the passage and embedded in the concrete.
- 25 15. An installation as claimed in any one of claims 1 to 11, in which an access door to the container has a lock mechanism comprising a bolt with an end of the bolt that will project into a stile, the bolt pivotally mounted on a pivot pin which is located behind a front surface of a door, the bolt recessed into a recess in the door, so that its outer surface is flush with the front surface of the door when in a secured position and means to lock the bolt when it is in this position.
- 30 16. An installation as claimed in claim 15, in which the locking means is a hasp formed in a recessed portion of the bolt and fitting when in the

secured position over a staple which projects from the recessed part of the door into which the bolt is recessed, through an aperture in the hasp, when in the secured position, for use of a padlock, which will be sheltered in the recess in the bolt when locked onto the staple.

5

17. An installation as claimed in either one of claims 15 or 16, in which two or more such flush mounted bolts are provided on a door and are linked with locking means to effect a single locking action which will lock all.

10

18. An installation as claimed in any one of claims 1 to 17, in which an access door to the container has a door hinge structure which comprises a flat plate which is fixed to a door and hinged on a hinge pin which is located behind the front surface of a stile, lintel or sill of a door frame, the frame having a slit into which the plate fits, presenting its narrow edge to the slit opening at the front surface of the frame, when the door is closed.

15

19. An installation as claimed in claim 18, in which two such plates are fixed to an upright edge of the door, the plate oriented horizontally, fitting into narrow slits in one stile of the door frame and hinged on hinge pins inside the door frame, to provide a horizontal swing of the door on a vertical axis.

20

20. A telecommunications installation as herein generally described.

21. A telecommunications installation as herein specifically described with reference to figures 1 to 5 of the drawings and as illustrated.

25

22. A telecommunications installation as herein specifically described with reference to figures 6 to 9 of the drawings and as illustrated.

23. A telecommunications installation having a secure door and lock as herein specifically described with reference to figures 10 to 17 of the drawings and as illustrated.
- 5 24. A method of installing telecommunications equipment as claimed in any one of claims 2 to 9, in which components for the mast or tower are carried in the adjacent zone during transport of the installation to a site, and the mast or tower is erected and other necessary steps taken.

FIG. 1

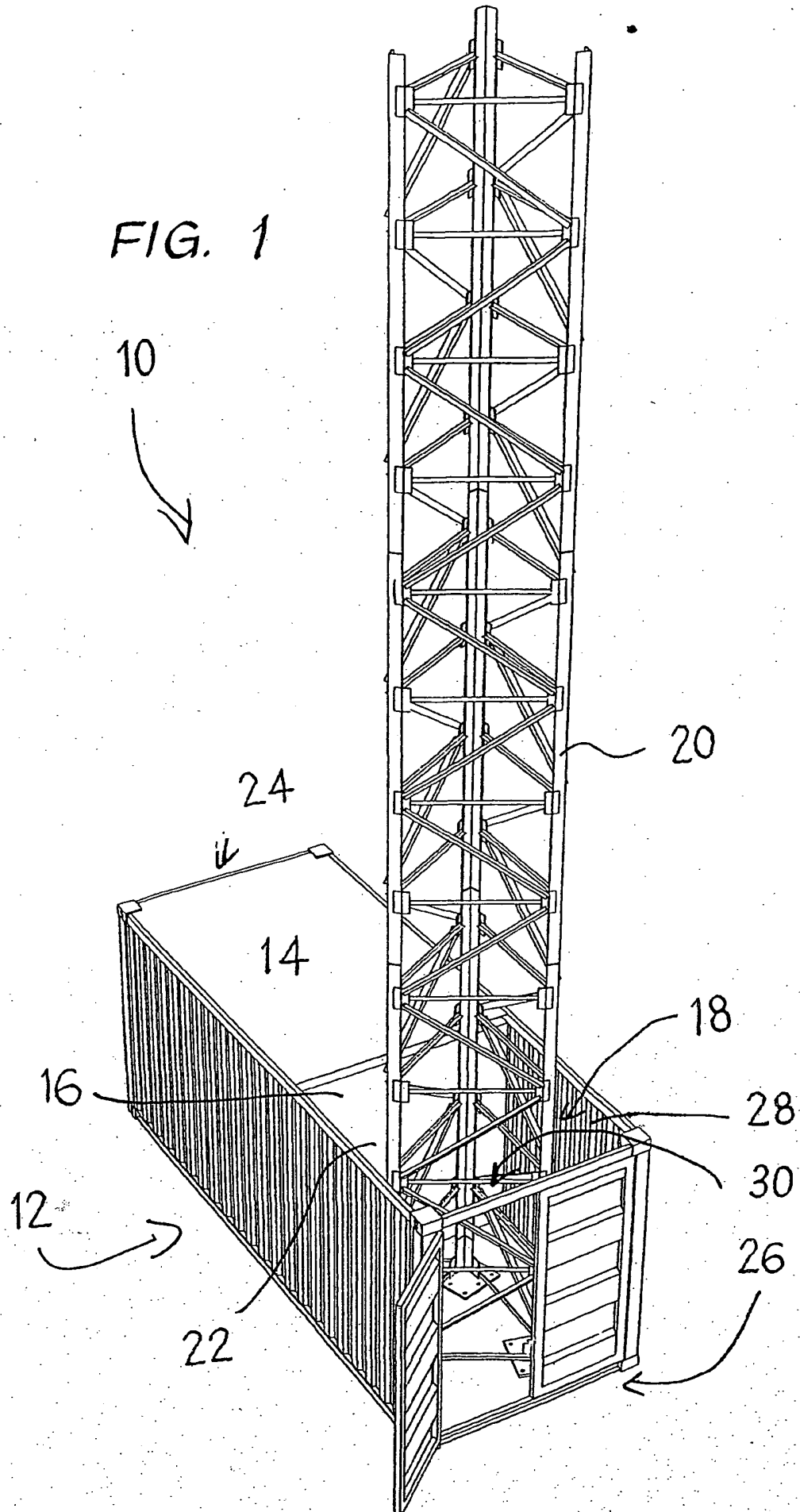


FIG. 2

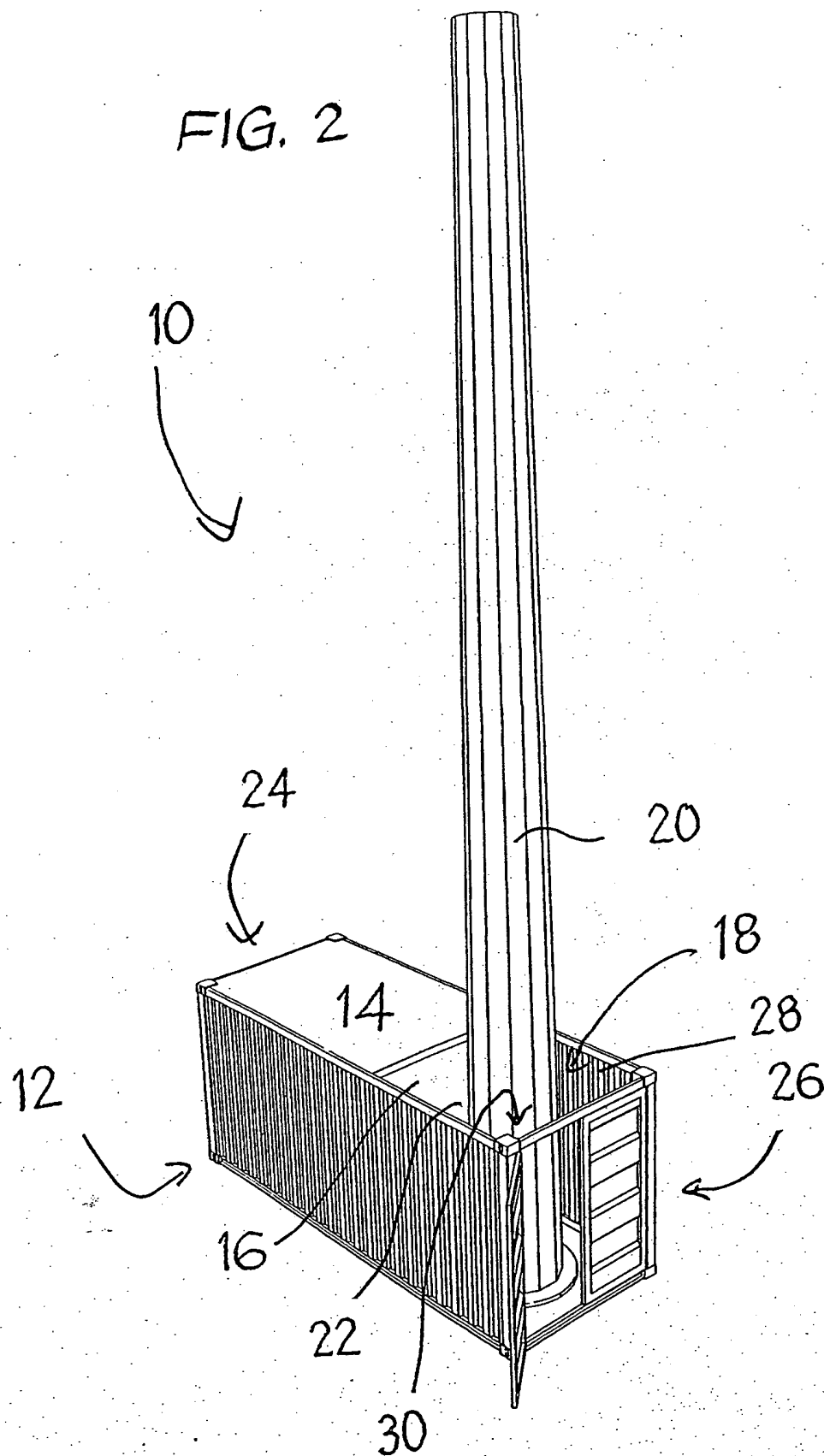


FIG. 3

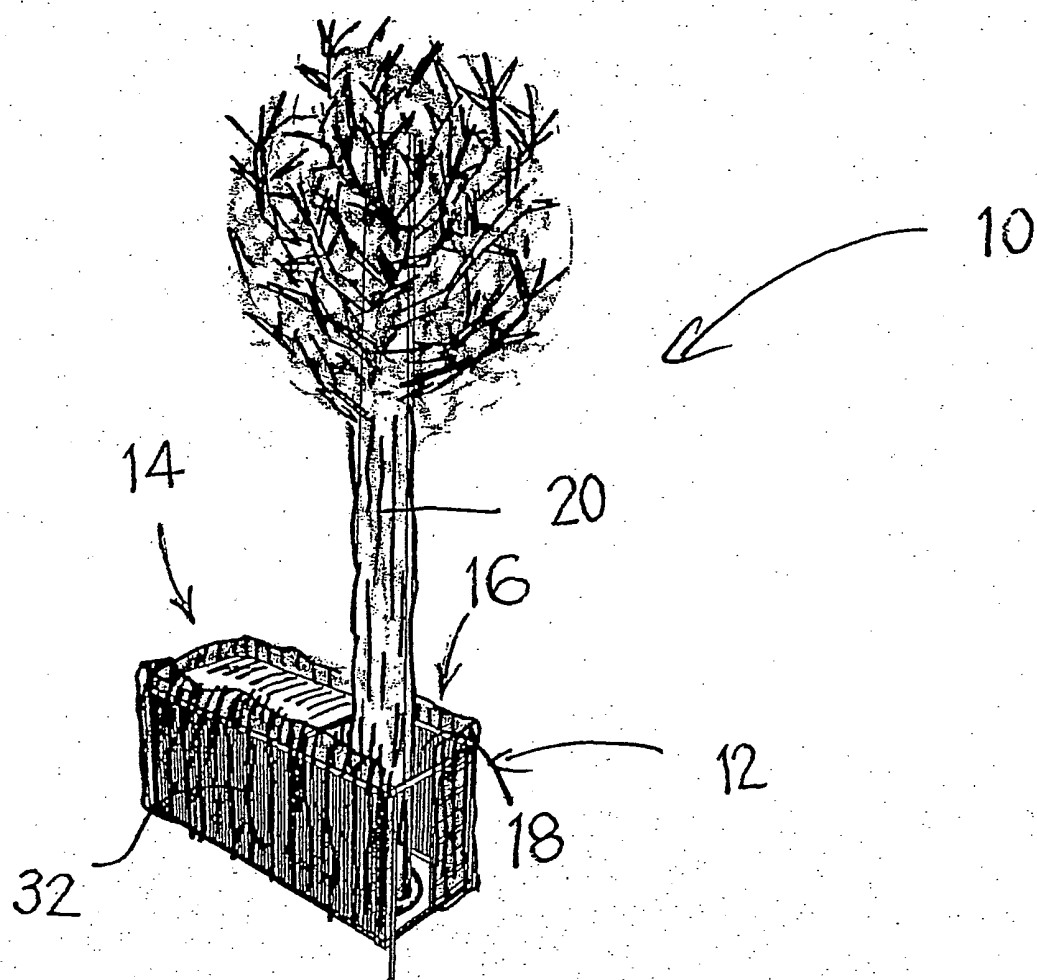


FIG. 4

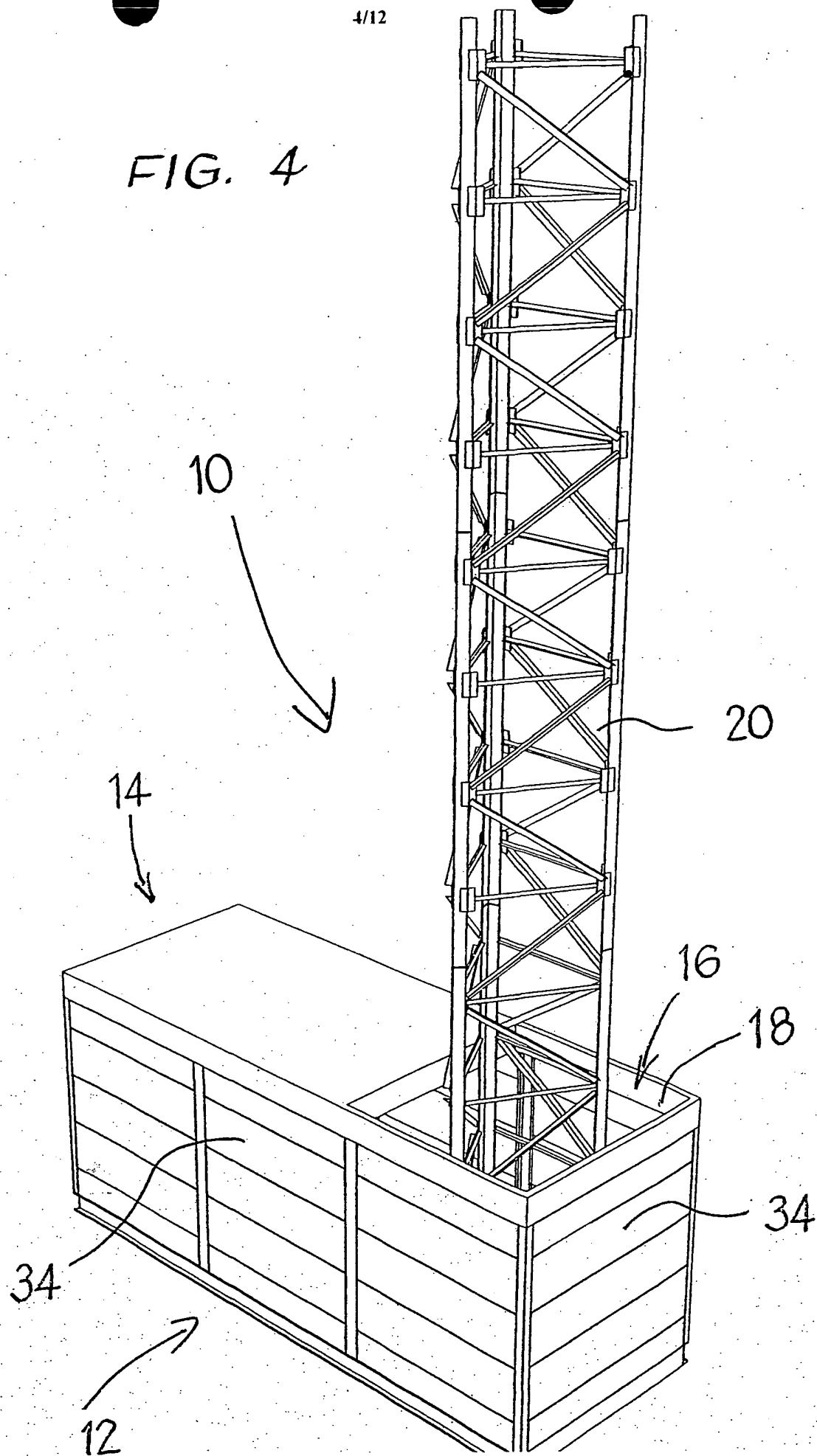
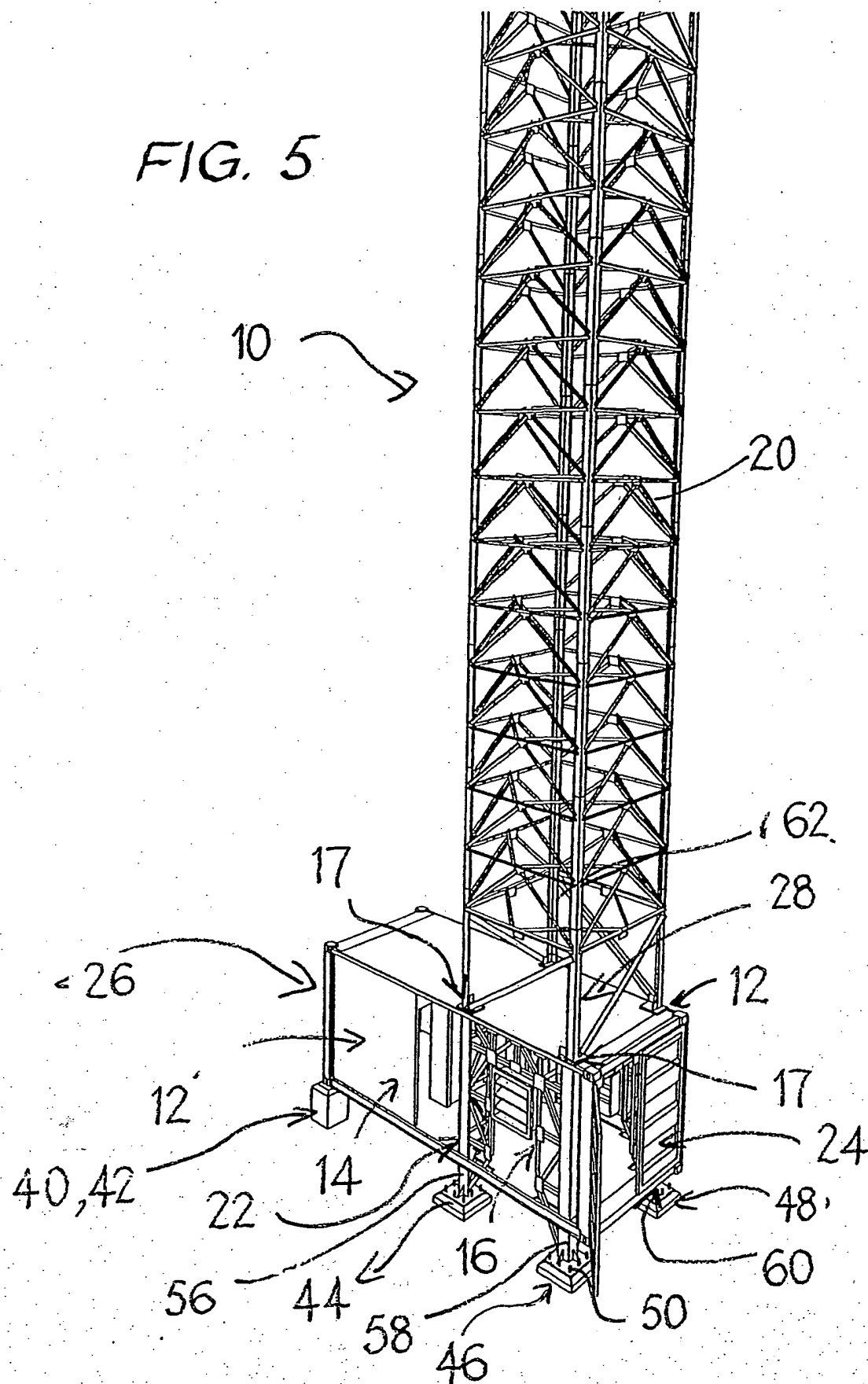
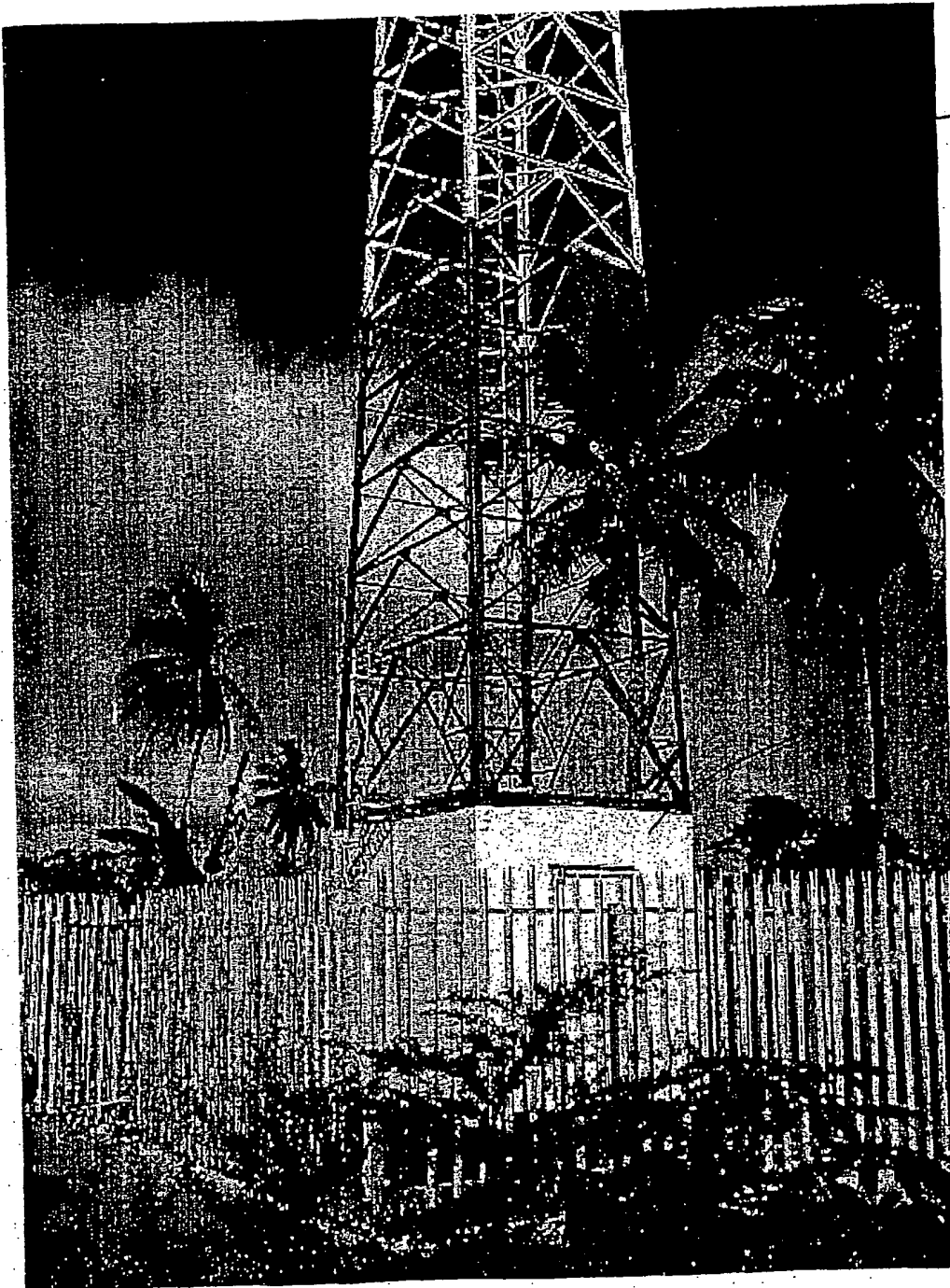


FIG. 5.





-71

FIG. 6

-74

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FIG. 7

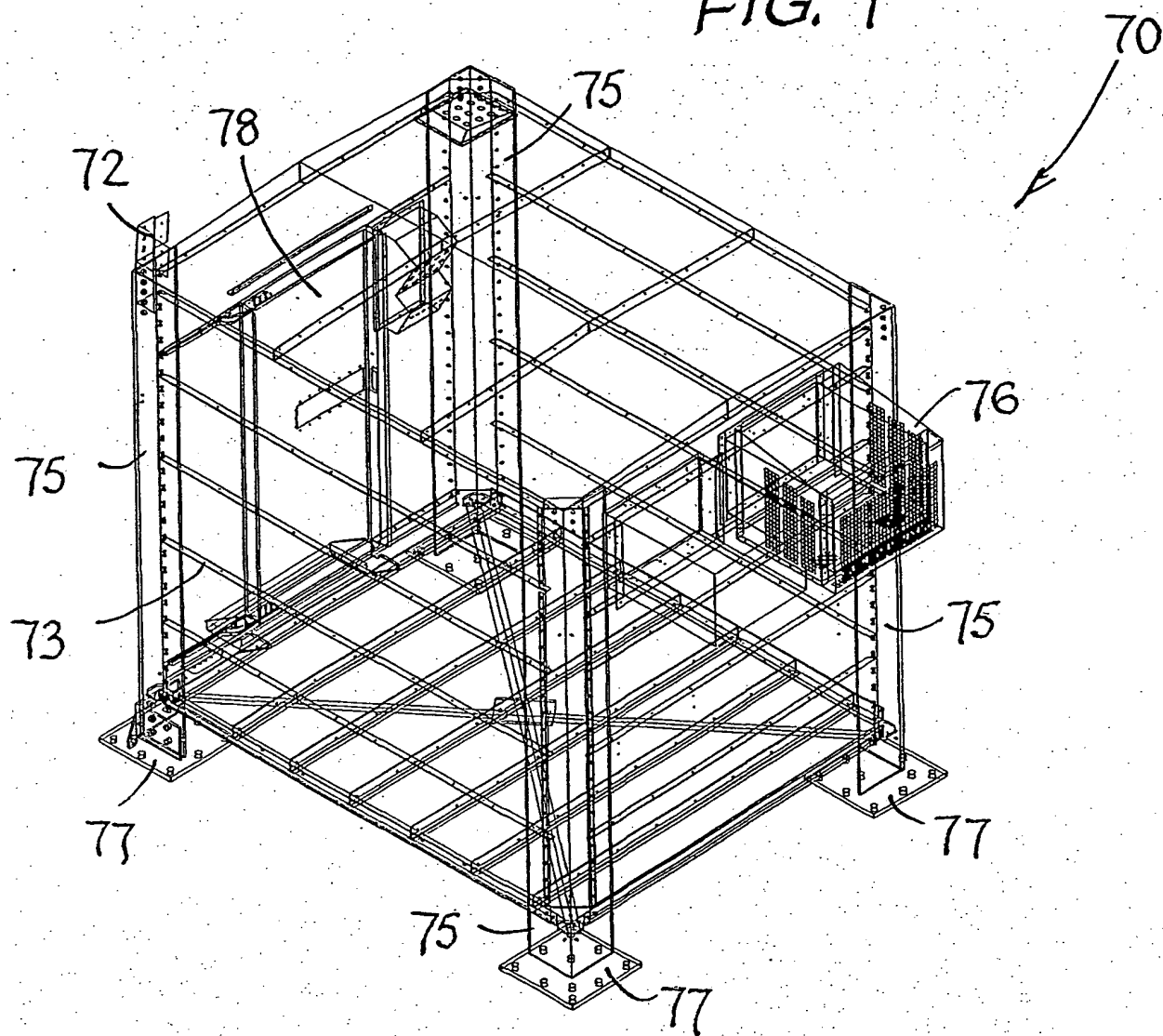


FIG. 8

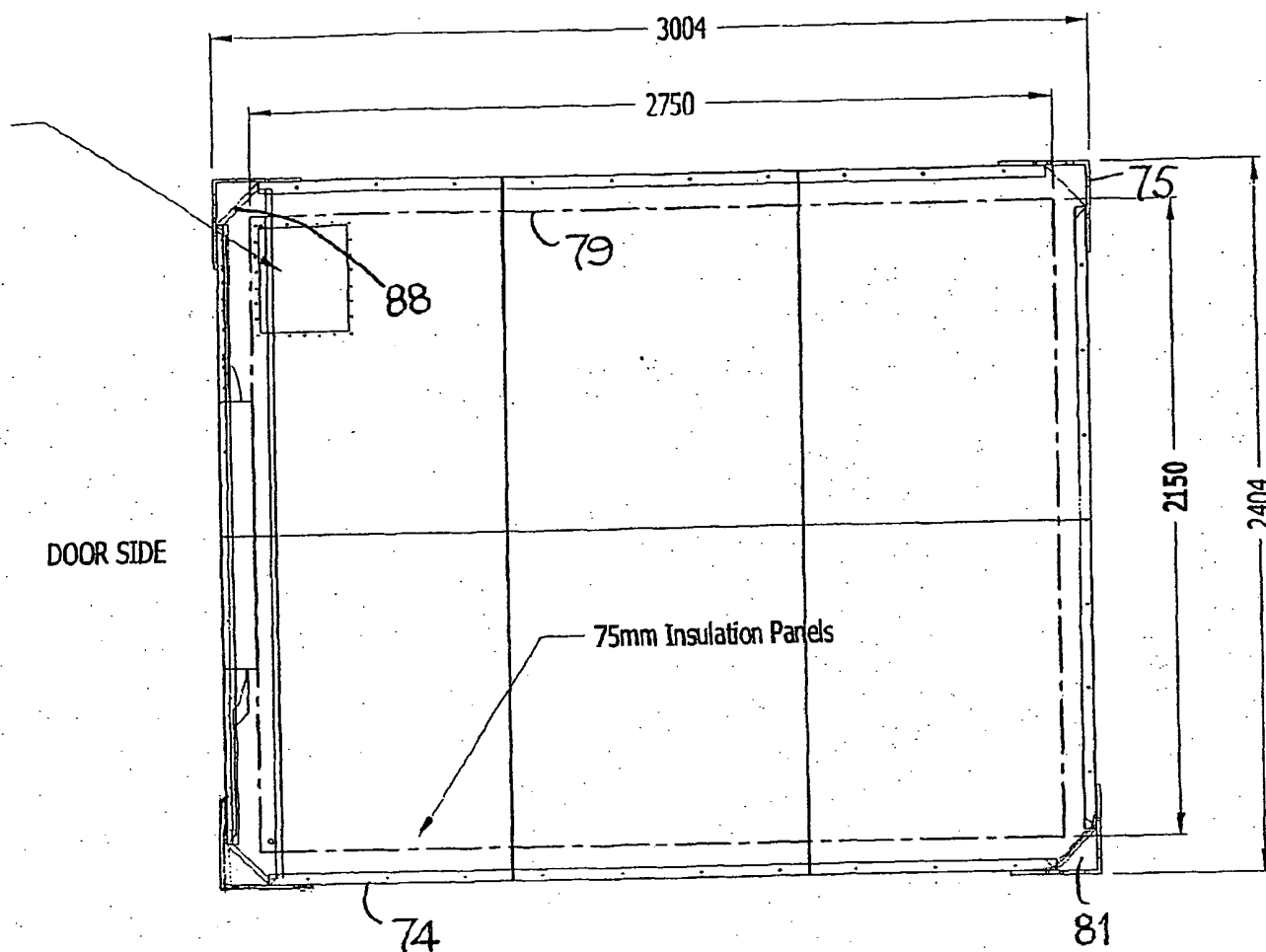


FIG. 9

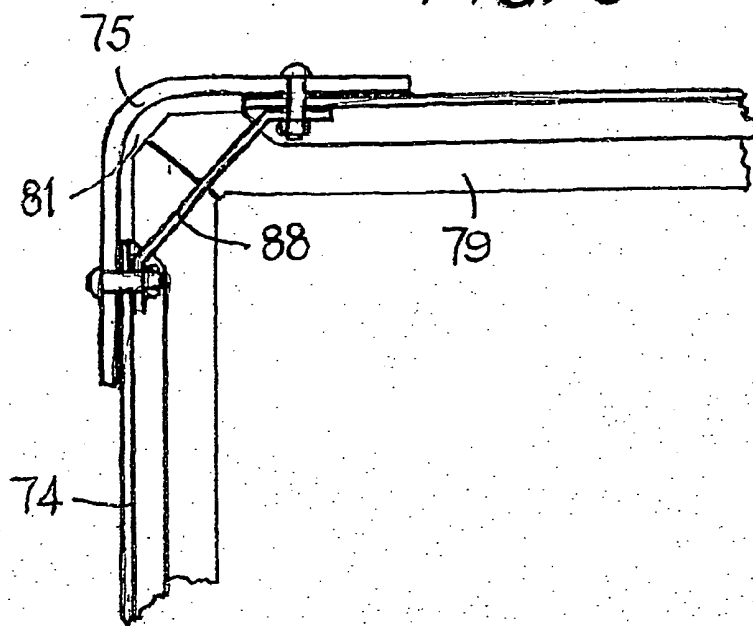


FIG. 10

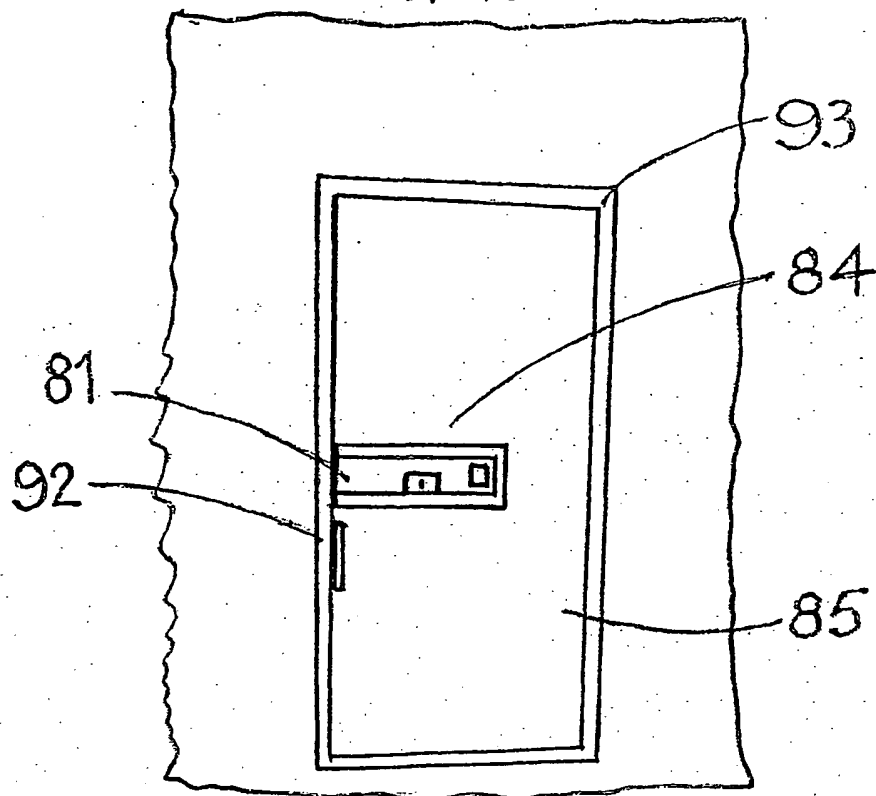


FIG. 11

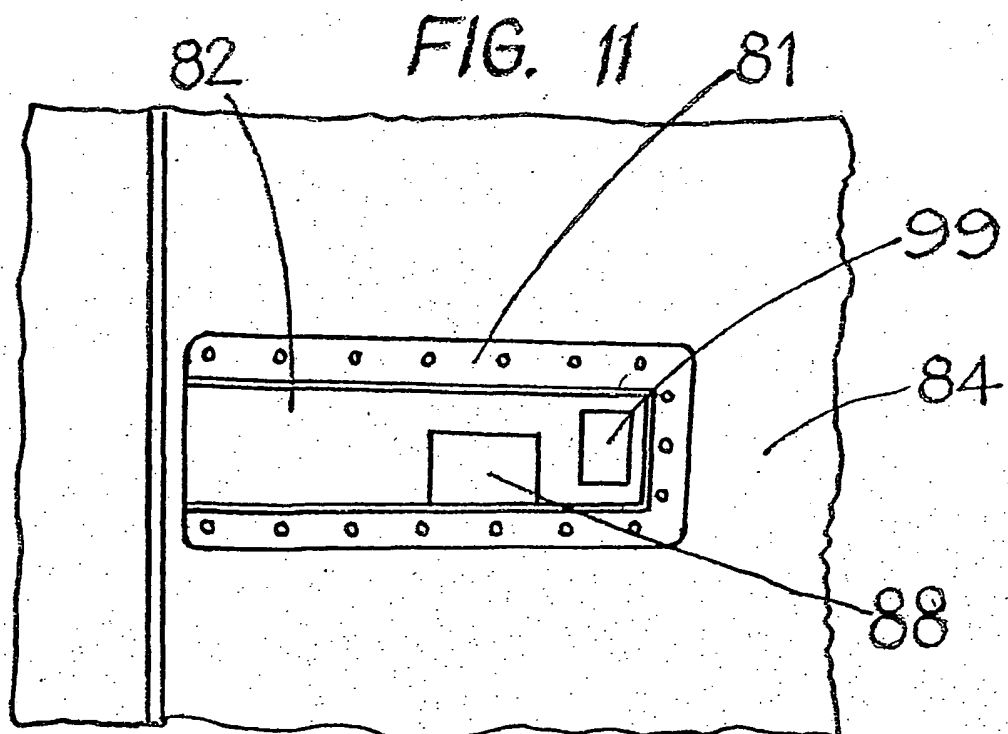


FIG. 15

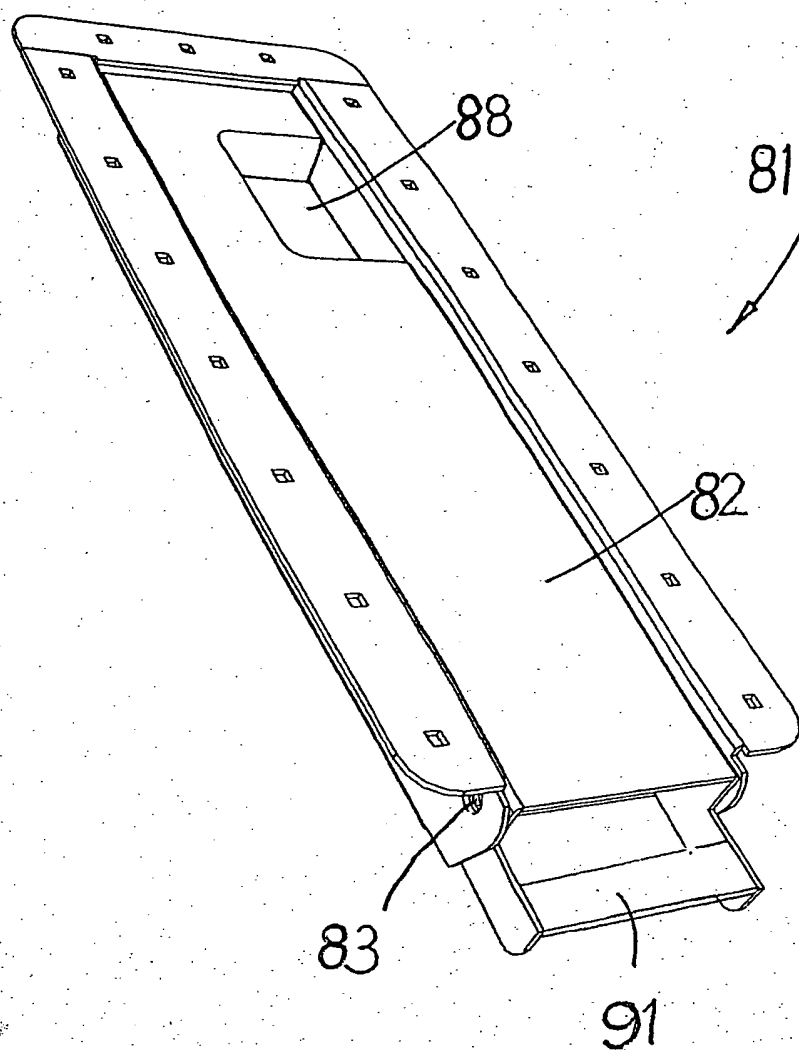


FIG. 13

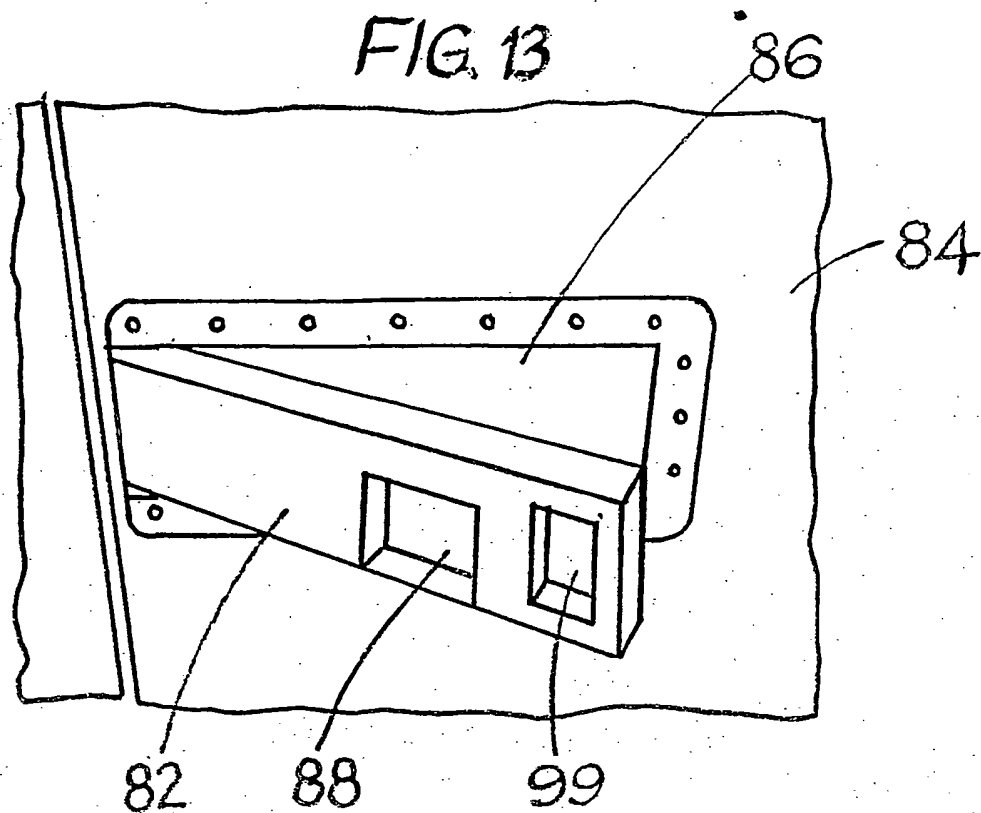
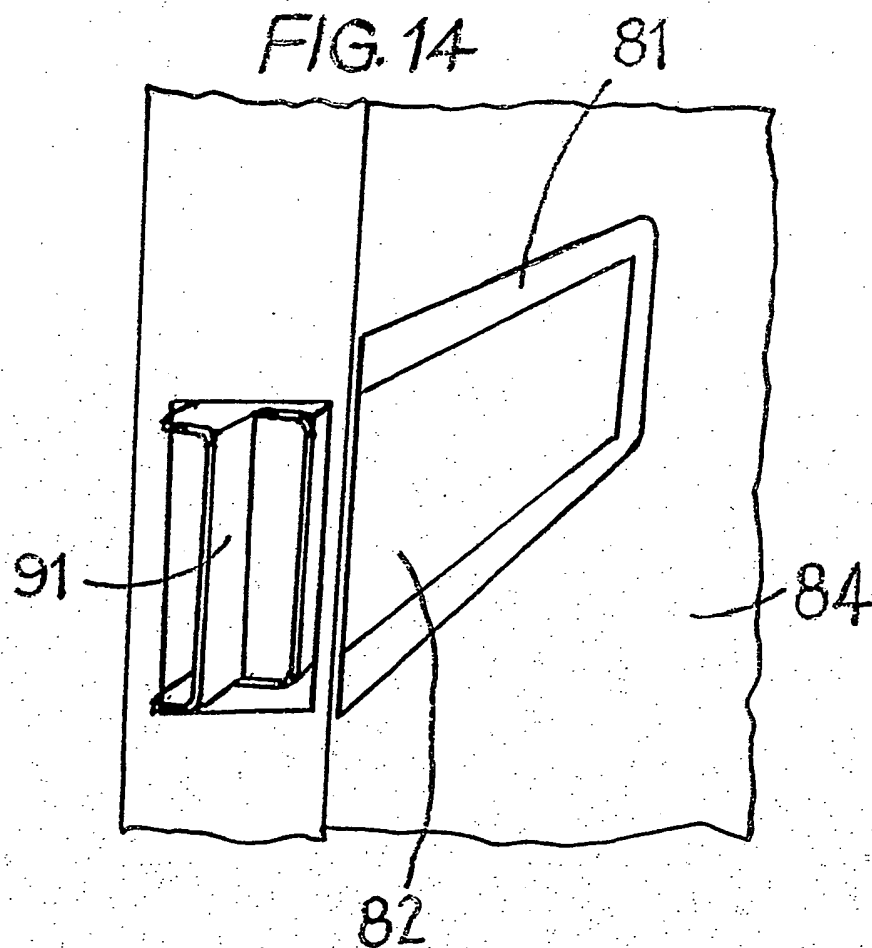


FIG. 14



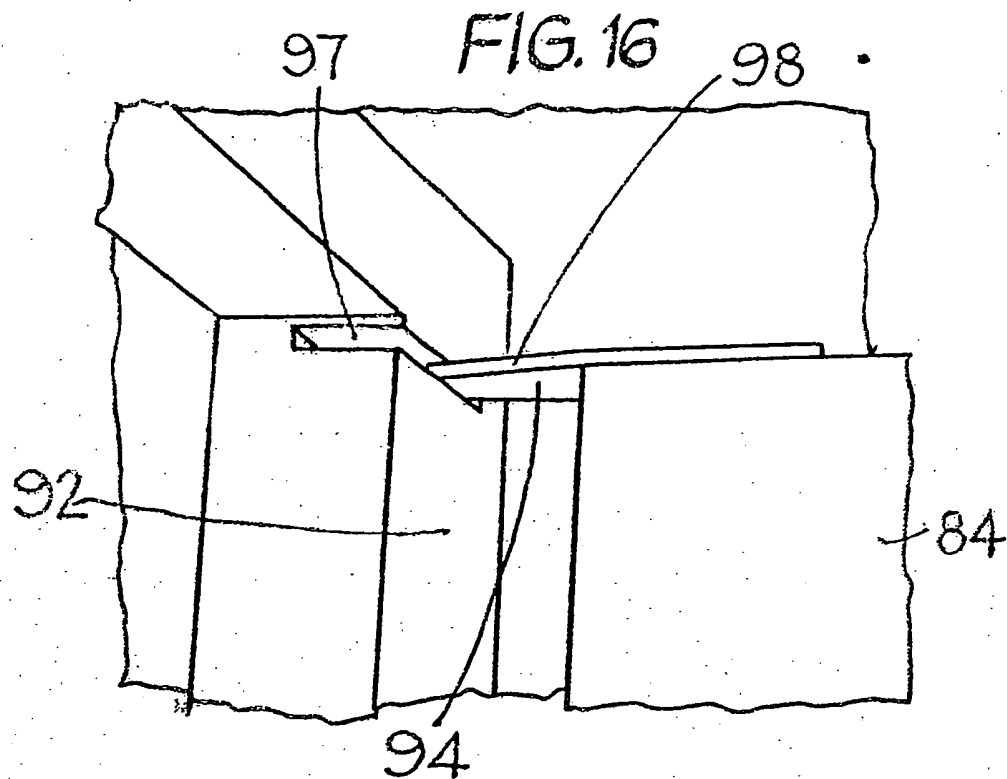


FIG. 12

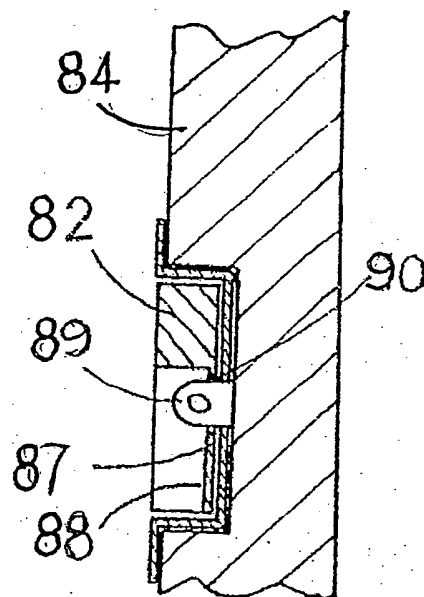
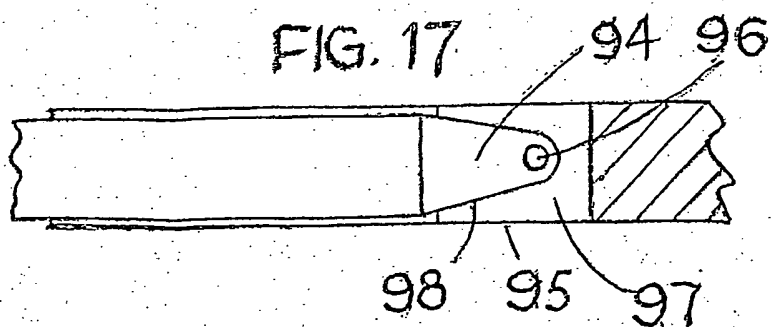


FIG. 17



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